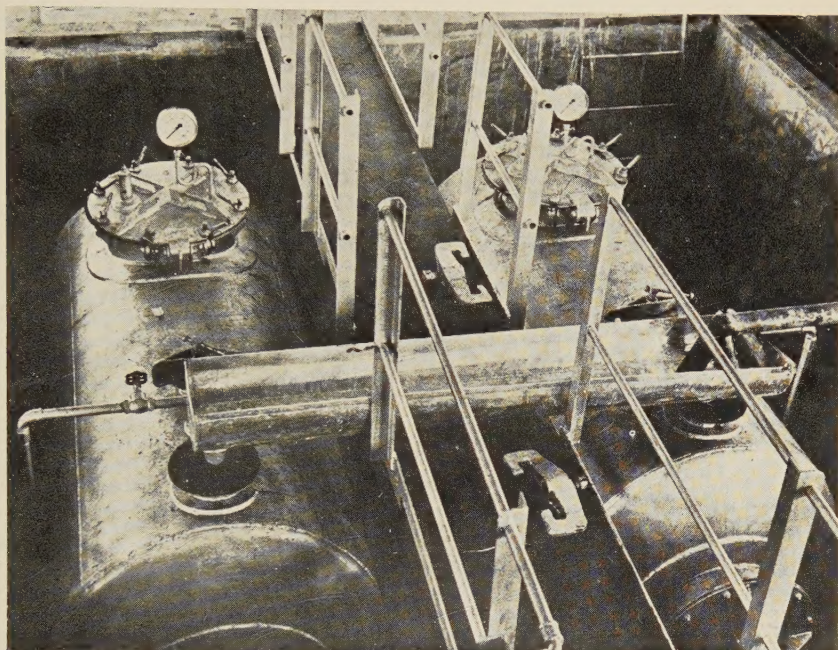


PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



PLANTERS' BULLETIN THIRTY

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R R I

LOCATION. The institute's laboratories and offices at the third mile, Ampang Road, Kuala Lumpur are open from 8 am to 1 pm and 2 pm to 4 pm on Mondays to Fridays, and from 8 am to 12.30 pm on Saturdays.

EXPERIMENT STATION AND FACTORY. This station of the R R I is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur — Kepong — Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement. There is a guest house.

CORRESPONDENCE. All LETTERS must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of particular officers. The address for TELEGRAMS is Searching, Kuala Lumpur. TELEPHONE: Kuala Lumpur 3351. PARCELS occasionally arrive without any indication of their origin. Senders' names and addresses should be written clearly on the outside of all packages, and advice of despatch should be given by letter or telegram.

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ADVICE. Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. Where it is considered necessary, visits will be made to estates in Malaya as convenient. Visits to estates in other territories are by special arrangement. The only visits for which charges are normally made are those of our budding mandores. INTERVIEWS should be arranged by letter, as members of the senior research and advisory staff are frequently absent on visits to plantations.

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PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur

May 1957

Number 30

An Appeal: Felling and Plant Collecting

In place of the usual Editorial, we present this appeal from the Botanic Gardens, Singapore, seeking the co-operation of estate managers with areas about to be cleared of forest.

The classification of flowering plants into the first sub-divisions of the plant kingdom or natural orders is based primarily on the flower form. In collecting botanical specimens it is essential to take parts of the plant which show this and other critical diagnostic features. Where collecting is to be carried out in forest it is clearly a difficult task to obtain satisfactory samples of trees and epiphytes living in the forest canopy which may be 100 feet or more above the ground. Mr E.J.H. Corner, who was Assistant Director of Botanic Gardens, Singapore, from 1929 to 1946, trained berok monkeys before the war to carry out tree top collecting. The operator, armed with binoculars, would spot from the ground specimens he wanted and by giving commands to the monkey, trained to understand a limited vocabulary, it could be directed to the specimens; these it would select, pick and throw to the ground, even descending to lower branches to free specimens caught up. These trained monkeys did not survive the war and the representatives of the post-war generation which were put to training had acquired new ideas of independence and service. They never became effective assistants to the would-be plant collector, who was left where he was before with his feet on the ground and the wanted specimens beyond reach.

A solution to this impasse would be to fell the trees in question — wasteful and hardly to be recommended. In many areas of Malaya, however, forest is being cleared for a purpose, to plant estate crops, to clear traces for roads, to develop irrigation schemes for padi planting and so on. In such areas of felling the plant collector can have a full selection of the canopy flora, can examine each tree as it comes down and take specimens of its flower and of the epiphytic orchids, ferns, etcetera, growing on it. In a visit recently to an area of forest clearing at least two first records for the State, which is one well known botanically, were found, and there may be others when all the material has been examined. We, in the Botanic Gardens, would like to pursue this line of plant collecting as it can undoubtedly be highly profitable.

The known flora of Malaya comprises some 8,000 to 10,000 different species of flowering plants and all the time new ones are being found. The flora of some parts of the country is well known. On Singapore Island, Bukit Timah, which is now a nature reserve and contains the only area of primary lowland forest on the island, has been

a happy hunting ground for botanists since 1820. It is certainly the most intensively collected area of primary forest in Malaya, yet it still yields up new records. On the other hand, in a two week collecting trip to Trengganu in 1955, Mr J. Sinclair, Keeper of the Singapore Herbarium, found 37% of his collection to be new records for the State and 11% were new species hitherto undescribed and unnamed. Many other parts of Malaya are equally little explored botanically.

We seek the cooperation of estate managers in the prosecution of botanical exploration. We will of course be glad to receive plant specimens from managers from all parts of the country, but what we ask at this juncture is that managers with a programme of new clearing (not replanting) within, say, the next 12 months let us know where, when and what acreage the clearing is to be. We will then be able to plan a series of tours for our Plant Collectors to cover the localities likely to be of the most interest to us.

Our Plant Collectors are Malays. If they could be accommodated on the estate it would of course be greatly appreciated. It would be helpful if managers in replying could state whether such accommodation would be available, and also whether there would be a smoke house or steam heated drying shed in use in which plant specimens and pressing paper could be dried. This would involve no displacement of rubber sheet or crepe as the space required would be small.

Please write to the Director, Botanic Gardens, Singapore, 10.

Mealy Bugs on the Tapping Panel

An interesting association between mealy bugs and ants was noticed on the tapping panel of a few clonal seedling trees on an estate in Selangor. The bugs, identified as *Planococcus citri*, were completely hidden under a shelter constructed of chewed wood fragments by a colony of black ants. It seems probable that the ants had deliberately brought the bugs to the tapping panel and were cultivating them in order to get their honeydew, for no other plant in the neighbourhood was infested. The shelters, which were somewhat like the earthwork made by termites, covered but a few square inches of the lower part of the panel



except on one tree where it extended over about a third of the panel, covering hundreds of bugs. The photograph shows some of them with their covering removed.

RRIM '600' Series Clones

THE OBJECT OF THIS ARTICLE is to summarise and review briefly the performance of the first selection of the RRIM '600' series clones, RRIM 600 to 618, and to a lesser extent the second selection, RRIM 619 to 630, and to make available at once information on which some choice of individual clones for multiplication in the nursery and budding in the field may be based. It is emphasised that at this early stage in the process of evaluating these clones, no firm conclusions may be drawn, nor recommendations made for planting except on an experimental scale.

The information presented comes from three sources, from small scale trials at our Experiment Station, from large scale trials also at Sungei Buloh, and from trials on estates.

Small Scale Trials, R.R.I.E.S.—In these trials nine to eleven points were budded in the field during the period 1939-42 with clones made from hand pollinated seedlings. After the Japanese occupation their yields were recorded and the thirtynine RRIM '600' series clones, RRIM 600 to 638, were selected from the original collection of seventeen hundred. Thus, the small scale trials have served their main purpose by providing data on which the RRIM '600' series clones were selected. Yield recording of the trees which provided the budwood of the clones chosen for large scale trials continues, and although the yield records from the small unreplicated plots cannot be very valuable by themselves, they do enable us, when they are considered in conjunction with the early yields of the large scale trials, to make a better informed appreciation of the clones. Results from the original trial were published in *Planters' Bulletin* 7 and 16.

Large Scale Trials, R.R.I.E.S.—There are three such trials. The first was budded in 1949 and stocks were cut back in April 1950; it contains clones RRIM 600 to 618, with RRIM 501 and Tjir 1 as controls. There are five randomised third of an acre plots of each clone. This trial completed its first year of tapping in September 1956. The second trial was budded in October to November and stocks were cut back in December 1950; it contains clones RRIM 619 to 630 with RRIM 501 as control. There are four replications of each clone, in third of



The large scale trial of the first selection, RRIM 600 to 618 at the Experiment Station, Sungei Buloh, six years after budding. Clone RRIM 605 is in the foreground.

an acre plots. This trial will complete its first year of tapping in June 1957. The third trial has a similar design to the second and contains clones RRIM 631 to 638; it was budded in 1955. No important information is yet available from this trial.

Trials on Estates—These trials with RRIM 501 as control, contain first selection clones, second selection clones, or a mixture of both; they were designed by the R.R.I. and laid out with the help and cooperation of the estates concerned. The areas are treated as normal commercial plantings except that regular visits are made by our staff to measure the growth of the trees and to make all necessary observations. By 1956 fiftyfour RRIM '600' series clones trials were established on estates.



Distribution of trials on estates of RRIM '600' series clones throughout Malaya.

To permit proper interpretation of the yield records in the table we have to explain the system followed in opening RRIM clones trials for tapping. When seventy per cent of the trees of the most vigorous clone or clones attain a girth of twenty inches or more at a height of sixty inches from the union, all the trees in the trial area which have then achieved such a girth are opened for tapping at fifty-two inches from the union. This system ensures that the most vigorous clone is tapped as soon as it reaches a commercial standard for tapping, so that subsequent yields per acre may be taken as a fair indication of what may be expected in a commercial planting.

At three monthly or six monthly intervals, as more trees attain the required girth they are brought into tapping. The date is noted at which seventy per cent of the trees of a given clone reach a commercial standard for tapping.

In order to avoid the type of exaggerated yield figures which can arise from multiplying the mean yield per tree per tapping by the stand of trees per acre and the number of tapping days per year, a system of recording* is used by which the sum total of the yields per acre contributed by each clone is the same as the yield per acre from the whole trial area as measured by the normal estate method of weighing the latex in the tappers' buckets and determining its dry rubber content.

* as described on page 58

LARGE SCALE TRIAL OF CLONES RRIM 600 - 618 AT THE R.R.I. EXPERIMENT STATION

Initial planting distance 20 ft x 10 ft. Stand at commencement of tapping 140 trees/acre.

Clone	Parentage of mother tree	Yield in first year of tapping				Virgin bark above panel mm	Rank on virgin bark mm	First year re-newed bark mm	Rank on re-newed bark	Brown bast		Rank on yield/tree in small scale trial	
		Grams per tree per tapping	Rank on gm/tree tapping	Actual yield lb/acre	Rank on actual yield lb/acre					Cases	Trees tapping end 1st yr	1st year tapping	8th year tapping
RRIM 600	Tjir 1 x PB 86	24.3	5	533	9	6.2	18	5.5	5	0	187	1	6
RRIM 601	Tjir 1 x Gl 1	16.5	18	469	11	7.1	2	5.5	5	0	208	16	9
RRIM 602	Tjir 1 x Gl 1	10.5	20	281	16	7.3	1	5.6	1	0	203	12	12
RRIM 603	PB 86 x Pil B 84	24.3	5	654	4	6.9	5	5.6	1	0	187	7	7
RRIM 604	Tjir 1 x PB 49	23.2	10	450	12	6.4	12	5.3	11	0	158	4	10
RRIM 605	Tjir 1 x PB 49	29.1	3	748	3	6.4	12	5.2	13	1	202	2	5
RRIM 606	Tjir 1 x PB 49	20.8	13	539	8	6.4	12	5.6	1	1	207	14	15
RRIM 607	Tjir 1 x PB 49	22.8	11	609	5	6.3	16	5.4	8	0	199	5	3
RRIM 608	AVROS 33 x Tjir 1	17.9	17	263	18	6.5	10	5.4	8	0	126	18	4
RRIM 609	AVROS 157 x BD 5	23.5	9	268	17	6.6	9	5.5	5	0	108	19	11
RRIM 610	RRIM 504 x Tjir 1	28.8	4	577	7	6.3	16	5.1	14	0	174	9	8
RRIM 611	RRIM 504 x Tjir 1	20.3	14	377	13	5.6	20	4.5	19	1	163	10	14
RRIM 612	AVROS 157 x PB 49	12.6	19	372	14	7.1	2	5.4	8	0	220	15	2
RRIM 613	Tjir 1 x RRIM 509	29.8	2	944	1	6.8	7	4.8	18	4	211	13	16
RRIM 614	Tjir 1 x RRIM 509	39.3	1	904	2	7.1	2	5.6	1	1	185	3	17
RRIM 615	RRIM 511 x Tjir 1	9.9	21	174	21	6.1	19	4.9	17	1	154	17	1
RRIM 616	Tjir 1 x RRIM 507	24.2	7	584	6	5.5	21	4.5	19	4	183	8	13
RRIM 617	BR 2 x RRIM 500	21.3	12	203	20	6.9	5	5.0	15	1	106	10	-
RRIM 618	Lun N x RRIM 501	20.0	15	263	18	6.7	8	5.0	15	0	120	5	-
RRIM 501	Pil A44 x Lun N	24.0	8	359	15	6.5	10	4.4	21	0	144	-	-
Tjir 1		19.7	16	507	10	6.4	12	5.3	11	0	196	-	-
Mean		22.0		480		6.5		5.2					

RRIM '600' Series Clones

LARGE SCALE TRIAL AT EXPERIMENT STATION RRIM 600-618

Initial planting distance 20 ft × 10 ft. Stocks cut back in April 1950.
Stand at commencement of tapping, October 1955, 140 tree/acre.

Clone	Mean girth* Oct '55	Trees tapped Oct '55 %	Rank on girths Oct '55	Mean girth* Nov '56	Trees tapped Oct '56 %	Rank on girths Nov '56	Pink disease Jan '55 % trees
RRIM 600	18.8	46	12	21.4	83	11	2.8
RRIM 601	20.1	64	4	22.8	91	2	4.4
RRIM 602	20.0	59	5	22.4	90	4	1.2
RRIM 603	20.4	65	2	22.0	84	8	2.0
RRIM 604	18.4	38	16	21.8	75	9	0
RRIM 605	19.3	51	11	21.5	89	10	0
RRIM 606	20.0	57	5	22.7	92	3	1.2
RRIM 607	19.9	58	8	22.4	89	4	2.8
RRIM 608	18.3	29	17	20.6	61	18	0
RRIM 609	17.5	16	20	20.5	57	19	0.8
RRIM 610	18.7	38	14	21.1	77	14	4.0
RRIM 611	18.6	32	15	21.1	78	14	6.4
RRIM 612	20.0	70	5	23.2	94	1	2.0
RRIM 613	21.1	79	1	22.4	94	4	1.6
RRIM 614	19.4	52	10	21.4	85	11	0
RRIM 615	18.8	37	12	20.9	73	16	0.8
RRIM 616	19.5	59	9	21.4	82	11	1.6
RRIM 617	17.3	12	21	20.5	55	19	1.2
RRIM 618	17.8	22	19	19.9	56	21	52.4
RRIM 501	18.0	24	18	20.6	71	17	87.2
Tjir 1	20.2	59	3	22.3	85	7	
Mean	19.1	46		21.6	79		

* mean girths are measured at 60 inches from union

Two methods of comparing the yields recorded in the first year of tapping are used in the table. Each method has its particular value. First, the mean yield per tree per tapping allows a comparison of the yield capacity of the trees and does not take into account differences in the numbers of trees in tapping. The mean yield is calculated from the yields of all recorded trees in tapping during the year. Second, actual yields per acre per annum afford a comparison in which a clone with a high yield per tree, but a low number of trees in tapping, may appear to be of the same productive value as another clone with a low yield per tree but a higher number of trees in tapping. To assess the value of a given clone, both types of yield records need to be examined in conjunction.

A comparison of the yields per tree for the first year of tapping in the large scale trial with those recorded for the first year of tapping of the small scale trial (*Planters' Bulletin* 7) shows a number of differences in the order of merit, and one point requires emphasis: those clones which were among the poorest yielders in the small scale trial, and which after a year or two became the highest yielders, have started poorly in the large scale trial. In particular, clones RRIM 612 and RRIM 615, which ranked fifteenth and seventeenth out of the nineteen clones first selected and which later ranked second and first respectively, have ranked seventeenth and nineteenth in the large scale trial. Similarly, some clones which started with a high yield in the small scale

RRIM '600' Series Clones

LARGE SCALE TRIAL AT EXPERIMENT STATION, RRIM 619-630

Initial planting distance 20 ft × 10 ft, Stocks cut back in December 1950.
Stand at commencement of tapping, July 1956, 140 tree/acre.

Clone	Parentage of mother tree	Mean girth* June '56	Trees tapped July '56 %	Rank on girths June '56	Pink disease June '55 % trees
RRIM 619	RRIM 501 × Tjir 1	19.1	44	6	1.8
RRIM 620	RRIM 501 × RRIM 511	19.4	51	5	10.1
RRIM 621	RRIM 504 × Tjir 1	20.3	75	3	8.3
RRIM 622	Tjir 1 × Pil B 84	18.4	43	9	6.1
RRIM 623	PB 49 × Pil B 84	21.3	90	1	3.1
RRIM 624	Tjir 1 × RRIM 529	17.7	13	12	8.8
RRIM 625	Tjir 1 × RRIM 526	21.3	84	1	3.1
RRIM 626	Tjir 1 × RRIM 500	17.8	14	10	2.6
RRIM 627	Tjir 1 × RRIM 526	20.1	56	4	6.1
RRIM 628	Tjir 1 × RRIM 527	18.6	32	8	2.2
RRIM 629	Tjir 1 × RRIM 529	17.8	25	10	3.1
RRIM 630	Tjir 1 × RRIM 527	17.6	13	13	2.6
RRIM 501	Pil A44 × Lun N	18.8	36	7	87.2
Mean		91.1	44		

* mean girths are measured at 60 inches from union

trial but which fell in rank after several years of tapping, have given a high initial yield in the large scale trial. Only after several years of tapping will it be possible to say definitely which are 'slow starters' and which 'precocious yielders'.

Virgin bark thicknesses and first year's renewed bark thicknesses are also given in the table. Clone Tjir 1 has average thicknesses for both while the other control clone, RRIM 501, has average virgin bark but lower than average renewed bark.

Vigour—The girths of the clones and the percentage of the tappable trees in October 1955 and a year later are listed in the table. The clones can be classified into five main groups, according to the age at which seventy per cent of their trees reached a girth of twenty inches, an acceptable standard for commencement of commercial tapping of budded trees. Age is reckoned from the date of cutting back the stocks in April, 1950.

5 years 6 months	RRIM 612, RRIM 613
5 years 9 months	RRIM 601, RRIM 602, RRIM 603, RRIM 605, RRIM 607, Tjir 1
6 years 3 months	RRIM 600, RRIM 610, RRIM 614, RRIM 616
6 years 6 months	RRIM 604, RRIM 611, RRIM 615, RRIM 501
Over 6 years 6 months	RRIM 608, RRIM 609, RRIM 617, RRIM 618

Girth measurements taken in immature RRIM clones trial on estates generally confirm these results as far as the most vigorous and the least vigorous clones are concerned, but the relative rankings of many of

RRIM '600' Series Clones

the clones show marked variation from site to site. RRIM 501, in particular, frequently ranks higher than it does in the large scale trial, where pink disease may have retarded its growth. We cannot yet recommend particular clones as being most suited even for broadly defined environmental conditions.



RRIM 616 may lean when rows are forty feet apart. The first fork is similar to that of Tjir 1, one of the parents of RRIM 616.

parents. RRIM 605, RRIM 608 and RRIM 614 appear to be particularly resistant; Tjir 1 is one of the parents of each of these new clones.

On the information available nine of the selections RRIM 600 to 618 appear to be more promising than the others, and four to be less promising. Too much weight should not be placed on the following remarks, which refer principally to observations made under one set of soil and climatic conditions. Until more records from estate trials are available no firm conclusions can be drawn.

Wind Damage — Several severe storms occurred in the large scale trials of the first selection of RRIM '600' series clones and the clones most susceptible to breakage by wind appear to be RRIM 613 and RRIM 616. It is interesting to note that both of these clones have Tjir 1 in their parentage. RRIM 603 was also affected by the storms; the trees bent but did not break. Both at the Experiment Station and in estate trials, the trees recovered completely after they had been straightened by roping.

Pink Disease — Of the series only RRIM 618 appears to be particularly susceptible to pink disease, though apparently not to the same extent as RRIM 501 or Lun N, its



Branching habit of RRIM 603.



Branching habit of RRIM 607.

PROMISING CLONES

RRIM 600—A good yielder in the small scale trial, average in the large scale trial for vigour and above average in yield. Virgin bark is average and first year's renewed bark above average in thickness. The clone is tall with a dense heavy crown but does not appear to be particularly susceptible to wind damage.

RRIM 603—A good yielder in the small scale trial and above average in the large scale trial with good vigour both on the Experiment Station and in estate trials. Virgin bark and first year's renewed bark are excellent. The trees are of medium height with well balanced crowns which are resistant to wind breakage. During immaturity the clone may bend when exposed to strong winds; this may be rectified by roping, after which it continues its upright growth.

RRIM 605—A good yielder in the small scale trial and well above average in the large scale trial. It is of average vigour at the Experiment Station, but has shown very good vigour in estate trials. Its virgin bark and first year's renewed bark are average for the trial and are similar to those of Tjir 1. The clone is not susceptible to wind damage.

RRIM 607—A good yielder in the small scale trial and above average in the large scale trial. Vigour is slightly above average in the large scale trial, and in estate trials. Its virgin bark is average and its first year's renewed bark is above average in thickness. The trees are short with a dense canopy and are not susceptible to wind damage.

RRIM 610—A good yielder in the small scale trial and above average in the large scale trial. It is slightly below average vigour in the large scale trial and in estate trials. The records available suggest that

the clone may grow better on coastal soils than on inland soils. Virgin bark and first year's renewed bark are of average thickness. The clone has a light crown and is not susceptible to wind damage.

RRIM 612—A slow starter in the small scale trial but it gave excellent yields after three

RRIM 610 at five years from budding. The clone in the background is RRIM 612.



RRIM 607, five years from budding on coastal soil.





RRIM 612 at five years of age showing the canopy closing over the 30 foot interrow. The gap in the row on the right is due to thinning, not wind damage.

vigour compensates somewhat for its low yield per tree in that a high percentage of trees are in tapping. RRIM 612 is vigorous in estate trials and consistently grows faster than the other clones after two year's growth. Virgin bark and first year's renewed bark are average in thickness. The trunk often has a slight crookedness but this is insufficient to be of any practical importance. The crown is dense and heavy but does not appear to be particularly susceptible to wind damage. Records indicate that the clone grows best in avenues, where its canopy quickly closes over.

RRIM 613 – A fair yielder in the small scale trial and well above average in the large scale trial. The most vigorous clone in the large scale trial until it was overtaken by RRIM 612 during the first year of tapping. It shows good vigour in all estate trials. Virgin bark is above average and its renewed bark is below average in thickness. The clone has a heavy branching system which has



Contrasting habits of RRIM 600, on left, and RRIM 613, on right.



resulted in some wind breakage.

RRIM 614 – A fair yielder in the small scale trial but easily the highest yielder in the large scale trial. It is vigorous in all situations but records suggest that it may do best on inland soils. Both virgin and first year's renewed bark are above average in thickness. The clone has a heavy crown and a

RRIM 603 at three years from budding.

RRIM '600' Series Clones



RRIM 614 with RRIM 612 behind, five years from budding.

dense canopy but is not particularly susceptible to wind damage. In some, but not all, situations marked nodules appear on the trunk and lower branches and in extreme cases they may cause difficulty in tapping. It may be practicable to excise these nodules without causing burrs, if excision is done early.

RRIM 615—Like *RRIM 612* a slow starter in the small scale trial but it eventually became one of the highest yielders. It is the lowest yielder in the large scale trial at present. Vigour is average in the large scale trial, but is above average in most estate trials where it can be excellent. Virgin bark and first year's renewed bark are slightly below average.

LEAST PROMISING CLONES

The clones which appear at present to be least promising, chiefly because of comparative lack of vigour, are listed below. It is emphasised that, although they show lack of vigour compared with the other clones in the series, they may not compare unfavourably with some of the clones at present being used for planting on a large scale.

RRIM 608—Well below average in vigour and although its crown is light, branching may be unbalanced, resulting in some wind damage. Yield in the large scale trial is below average but records from the small scale trial suggest that it is a slow starter. The virgin bark and first year's bark renewal are average in thickness. This clone may later prove to be more valuable than it appears to be at present.

RRIM 609—The comparative lack of vigour of this clone is marked at the Experiment Station and in estate trials. Its virgin bark and first year's renewed bark are slightly above average, as also is its yield per tree in the large scale trial.

RRIM 617—The least vigorous clone in the large scale trial and of poor vigour in estate trials. The yield per tree and the first year's renewed bark are slightly below average.

RRIM 618—Only *RRIM 609* and *RRIM 617* are less vigorous in the large scale trial, and it shows lack of vigour in estate trials. Yield per tree and the first year's renewed bark are below average. Susceptibility to pink disease is a serious fault.

Of the selection *RRIM 619* to *630* little can be said at present except that *RRIM 623* shows good vigour at the Experiment Station and on estate trials and appears to have good secondary characteristics.

The quality of latex and dry rubber, both crepe and sheet, derived from the individual clones is being investigated and a note on this aspect of selection should follow in due course.

We hope to review the list of promising RRIM '600' series clones from time to time, when alterations may be made in the light of additional information. Meanwhile we consider that those listed as promising at present are worth budding in areas of up to twelve acres in preference to the others, in plantings or replantings where the area or the planting policy does not permit the budding of all of the series on this scale.

The remarks concerning promising clones which are given in this article supercede the earlier appreciation which was provided in response to individual enquiries, in the course of advisory correspondence, in the cyclostyled note B/M 45(56).

Pests of Legume Cover Crops

LEGUME CREEPERS are now regarded as essential covers in young rubber replantings. The three almost exclusively employed — *Centrosema pubescens*, *Pueraria phaseoloides* and *Calopogonium mucunoides* — are attacked by a number of insect pests which, though not generally serious once the cover is well established, can greatly retard growth in the early stages before the plants have extended far from the original drills or planting points.

The four most important insect pests, all leaf feeders, are selective as to the plants they will attack. The ladybird beetle *Epilachna indica* attacks *Centrosema* alone of the three covers named, while another beetle *Pagria signata*, a bug *Chauliops bisontula* and a caterpillar *Lamprosema diemenalis* attack *Pueraria* and *Calopogonium*.

It is a curious fact that ladybird beetles fall into three groups widely differing in their feeding habits. In the largest group they are predacious on other insects; in another (which includes *Epilachna*) they feed on plants, while there is a small group that feed on fungi. Mildew (*Oidium heveae*) on rubber leaves

Centrosema leaf attacked by the ladybird beetle, *Epilachna indica* (inset $2\frac{1}{2} \times$ linear).





Pueraria leaf attacked by the beetle *Pagria signata* (inset $5 \times$ linear).

is browsed by a small yellow species.

Epilachna indica has the usual shape of a ladybird beetle. It is a quarter of an inch long, the wing covers dull reddish brown in colour with twelve black spots, some of which may run together. Cigar shaped pale yellow eggs are laid in clusters on the underside of leaves, a single female

laying up to a thousand or more in her life. Larvae are yellowish, the body bristling with long branched spines; pupae, protected within the last larval skin, hang head downwards from the plant. The whole life cycle lasts about a month. Both larvae and adults feed on the underside of young leaves, eating the tissue between the veins, which are left standing out prominently, joined by the transparent upper cuticle. Where the pests are present in large numbers they quickly destroy the foliage, attacking new flushes as they are put out, at worst reducing *Centrosema* to bare stems.

Pagria signata is a much smaller beetle, a tenth of an inch long, easily recognised under a lens by its golden wing covers with a pair of dark spots at the front, and with black inner edges of the wing covers forming a prominent line down the middle. The life cycle is not known for certain, but the larval stage is believed to be passed in the soil.

Leaf of *Calopogonium* grown* in a glasshouse attacked by the bug *Chauliops bisontula* (inset $5 \times$ linear).



Both *Pueraria* and *Calopogonium* are attacked by this beetle, which feeds on the upper surface of the leaf, leaving irregular brown patches which later perforate. The damage may be considerable, more than half of the leaf area being destroyed.

Chauliops bisontula is a bug which sucks the leaves of several leguminous plants. It is a little smaller than *Pagria*, ash grey in colour. Eggs are laid separately on the underside of leaves. The nymphs which hatch out are reddish at first, becoming dark brown with age. Both they and the adults feed on *Pueraria* and *Calopogonium*. Though they feed on both surfaces of the leaf, the upper surface is preferred perhaps because it is less hairy. It is not easy to assess the damage caused by the bugs as they always occur together with *Pagria*, often being found inside the holes made by the beetle.



Leaves of *Pueraria* attacked by caterpillars of the moth *Lamprosema diemenalis* (inset $1\frac{1}{4} \times$ linear).

The caterpillar of *Lamprosema diemenalis*, a small yellow and brown moth with a wingspread of three quarters of an inch, locally causes severe damage to the leaves of *Pueraria* and to a lesser extent to *Calopogonium*. *Centrosema* is rarely attacked. The caterpillar is green with an amber head, and attains a length of three quarters of an inch when fully grown. It either rolls a leaflet or binds two leaflets together to make a shelter inside which it feeds. A large part of the leaf that forms the shelter is consumed, reduced to a thin film, skeletonised or completely eaten. A mass of frass in the form of small dark grey pellets is seen within the shelter.

Other pests that are encountered on legume creepers are rarely troublesome. Caterpillars of a small blue butterfly sometimes destroy unopened

flowers of *Pueraria* and thus may become a problem to those who hope to collect seed. A small black weevil, too, will sometimes be found damaging the young flowers. Mealy bugs are invariably present in small numbers on the leaves, while the roots of all three covers are liable to attack by eelworms. Eelworm galls, which are irregular swellings of the main roots, are easily distinguished from *Rhizobium* nodules,

which are more regular structures formed on hair roots. Though insecticides which will control the various pests are known, the impermanence of legume covers in rubber cultivation, and the sporadic nature of pest outbreaks, make it impossible to formulate precise recommendations for control measures. Covers that have advanced far beyond the original drill or planting point should be robust enough to withstand heavy infestations. It is in the early stages of establishment, when pests may seriously retard growth and when treatment is a less heavy undertaking, that control measures are likely to be worth attempting.

Spraying with a suspension of lead arsenate in water is a cheap and effective method of combatting leaf eating pests, but for treating legume creepers it has the demerit of sometimes scorching the leaves. DDT has been found to be better; applied either as an emulsion or a suspension in water at a concentration of 0.25% of the active ingredient, or as a 5% dust, it is destructive to both the beetles described above, and to the bug. A week or more after treatment, depending upon the proximity of untreated covers, a few of the pests may be noticed on the new flushes. A second application is then necessary, and it may have to be repeated again if there are large areas of untreated covers in the neighbourhood. Though DDT is also effective against caterpillars, *Lamprosema*, because of its habit of feeding in concealment, may require a more penetrating insecticide. Endrin at a concentration of 0.025% has proved successful in this situation. However, outbreaks of caterpillars in rubber plantations are generally brought to an end through the activity of parasites and predators.

Safety of Welded Latex Tanks

We have pleasure in presenting a further guest article by the Deputy Chief Inspector of Machinery, of the Federation of Malaya.

NEARLY EVERYONE appreciates the hazards associated with boilers and steam plant, yet surprisingly fails to realise that similar risks—albeit to a lesser degree—attend vessels containing air under pressure. Responsible persons, who would never dream of purchasing a boiler except from a reputable manufacturer, can and do order pressure vessels from the local tukang. This criticism is not intended as a reflection on the skill of Malayan boilermakers, which is often of a high order, but to draw attention to the fact that only two or three firms in the Federation are capable of designing a satisfactory pressure vessel.

Unfortunately, work has frequently started on the manufacture of the pressure vessel before the design is submitted to the Machinery Department for approval. Sometimes it is found that the design is so unsound that no safe working pressure can be assigned to the vessel. In most cases the proposed working pressure has to be reduced to a value appropriate to the method of construction and materials used.

Safety of Welded Latex Tanks

All of this incurs unnecessary delays and expense. The foregoing remarks apply to all pressure vessels and have particular reference to welded latex storage tanks which are the most common type in this country.

Two aspects have to be considered in the matter of safety of latex storage tanks: first the design of the tank and its fittings; and second, the maintenance of the tank. Space does not permit a detailed discussion of the various designs that can be employed, but the following points may be of interest to someone about to order a latex storage tank.

The design necessarily includes the material from which the tank is made. Only two metals need be considered, steel and aluminium alloy. Of the many grades of steel on the market not all are suitable. A steel manufactured by the acid or basic open hearth processes containing less than 0.05% of sulphur and phosphorus, with an ultimate tensile strength of 24 to 28 tons per square inch, should be employed. Steel in accordance with British Standard 14:1942 is ideal. Unless the grade of the steel is specified, ordinary commercial quality steel of continental origin is likely to be used, and this is unsuitable. Where aluminium is used the quality should comply with British Standard 1477:1951 or the American Society of Mechanical Engineers' specification S.B.-178.

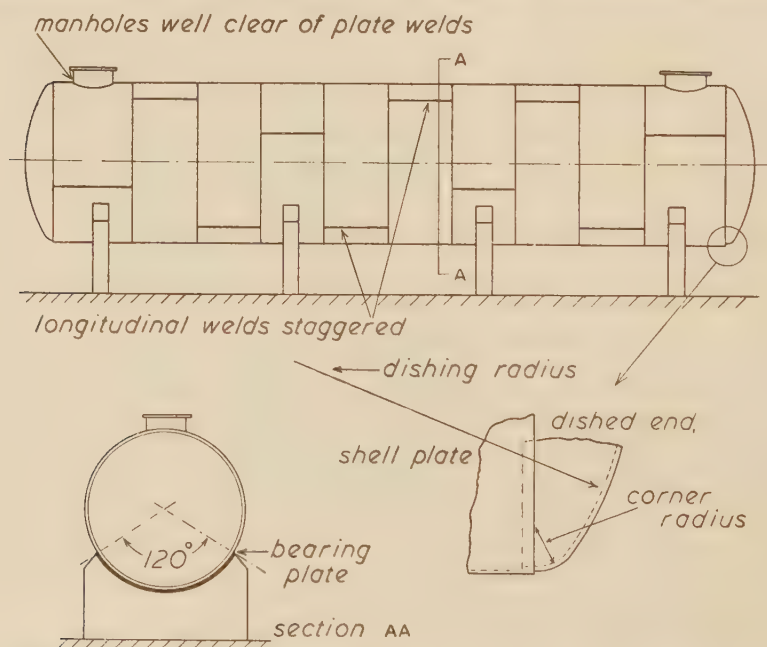


Figure 1. A 20,000 gallon welded latex storage tank, of working pressure 30 pounds per square inch.

A suitable design for a 20,000 gallon latex storage tank appears in *Figure 1*. The ends are dished. The radius of the dishing should never exceed the internal diameter of the vessel. Where the dishing joins the

Safety of Welded Latex Tanks

cylindrical portion of the end a good corner radius is provided. This radius is critical in assessing the strength of the end of the vessel; it should be as large as possible and never less than 6% of the internal diameter of the vessel. If possible the end plate should be made from a single plate. When two or more plates have to be joined to form the end, allowances must be made for the strength of the weld. This usually results in the use of a plate which is thicker than necessary.

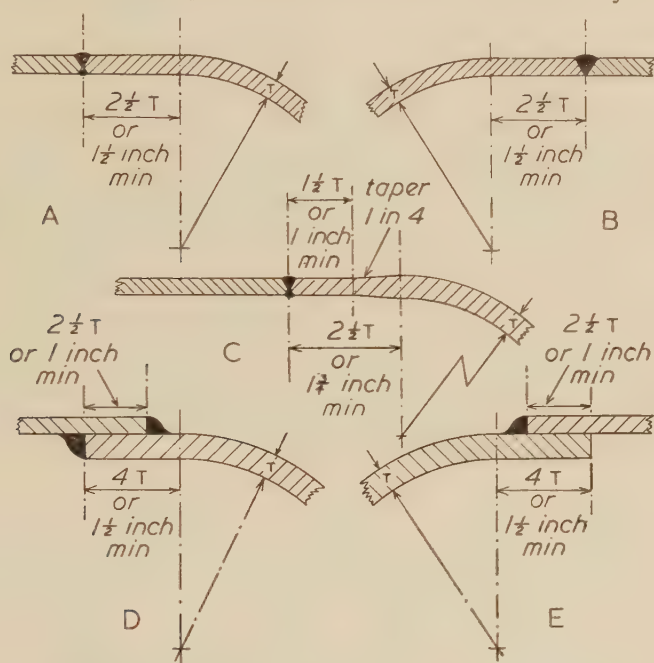


Figure 2. Suitable latex tank end attachments:

- A Double welded butt joint recommended for all thicknesses of plate.
- B Single welded butt joint for plate not thicker than $\frac{5}{8}$ inch.
- C Double welded butt joint for plate not thicker than $\frac{1}{2}$ inch.
- D Double welded lap joint for plate not thicker than $\frac{5}{8}$ inch.
- E Single welded lap joint for plate not thicker than $\frac{1}{2}$ inch.

The method of attachment of the end plate to the shell is important. There are only two satisfactory methods; either the dished end butts against the end of the shell or it slips inside it. Figure 2 shows the types of attachment. Types A, C and D necessitate internal welding, and therefore can be used only in latex tanks of substantial size. Types B and E are suitable for plates up to $\frac{5}{8}$ inch thick and type C for plate up to $\frac{1}{2}$ inch thick. Very few latex tanks have plate thicknesses exceeding $\frac{3}{8}$ inch. Generally the most satisfactory type is D. Figure 3 shows types of end attachment which are not permitted.

The shells of all latex storage tanks consist of one or more cylindrical plate rings. Except in very small tanks there is more than one plate in each ring. Plates making up individual rings (strakes) must be

Safety of Welded Latex Tanks

double butt welded. Rings may be welded to each other to form the cylindrical body by butt welding single or double, or by lap welding. The longitudinal welds in each ring should not coincide with the welds in adjacent rings.

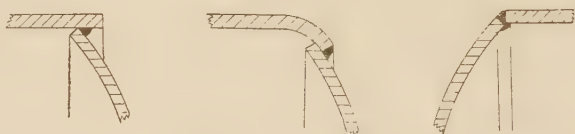


Figure 3. Types of end attachment not permitted.

All latex storage tanks need openings cut for access, inspection, and to accommodate the required fittings. If the tank has an internal diameter over 36 inches, one or two manholes should be provided. Suitable sizes are 16 inch $\times$ 12 inch if oval, and 18 inch diameter if circular. The openings should be cut in the shell well clear of all welds, and if an oval opening is selected the shorter axis should be arranged longitudinally. The cheapest form of manhole opening consists of a circular branch welded into the shell and closed by a blank flange, *Figure 4*. When the shell plate is cut for the opening the strength of the shell is reduced, and reinforcement is sometimes needed. With all common sizes of latex tank it is only necessary to compensate the shell plates in way of the manhole openings.

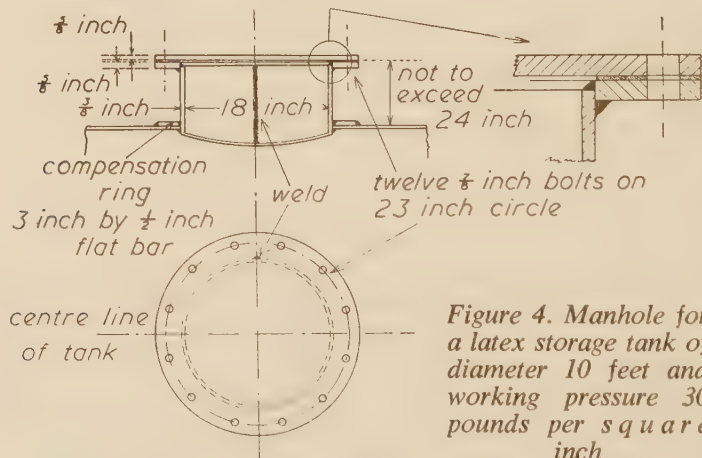


Figure 4. Manhole for a latex storage tank of diameter 10 feet and working pressure 30 pounds per square inch

In addition to the necessary fittings for filling, emptying, draining and blowing out, the law requires that each latex tank shall be provided with a safety valve and a pressure gauge. Where the source of compressed air is at a greater pressure than the assigned safe working pressure of the tank, a pressure reducing valve is also required.

The safety valve should be of the lock up, spring loaded type. If the valve is attached directly to the shell there should be no fins or guides on the valve lid. This is to prevent 'gumming' of the valve lid to the

Safety of Welded Latex Tanks

bore. It is often convenient to fit the safety valve on a branch or on the air inlet pipe, but, wherever it is fitted, there must be no stop valve between it and the latex tank.

The pressure gauge should be provided with a syphon tube and a shut off cock between it and the shell. The safe working pressure of the tank should be marked by a red line on the gauge. If a pressure reducing valve is necessary, it must be placed between the source of pressure and the safety valve.

A point sometimes overlooked is that under certain circumstances a vacuum can be created in latex storage tanks. Such conditions arise when latex is discharged from the storage tank to some other tank situated at a lower level. Large cylindrical shells are not capable of withstanding external pressure to the same extent as internal pressure. Latex tanks have been known to collapse from this cause when latex was being discharged into tanks on board vessels. Where there is any possibility of such circumstances arising an automatic vacuum release valve should be fitted.

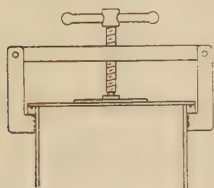


Figure 5. Common type of manhole cover, particularly on mobile storage tanks. The thickness should be at least $\frac{3}{8}$ inch, and a disc of the same thickness should be welded on top to distribute the load imposed by the clamping screw.

All large latex storage tanks are horizontal and need support. Usually the supports are of masonry or reinforced concrete. On bad ground it is advisable to build the supports on a reinforced concrete raft. Any subsidence of the central supports greatly increases the stress in the tank shell, and may lead to buckling. If only two supports are used they should be at the quarter and three quarter length points. Generally the distance between supports should not be greater than twice the diameter of the tanks and preferably should not exceed 14 feet.

The supports or cradles should subtend an angle of about 120° with the centre of the tank (*Figure 1*). It is always advisable to fit steel bearing plates between the tank and its supports—these plates are essential if masonry or reinforced concrete supports are used.

Latex tanks do not require a great deal of maintenance. They are subject to external corrosion, particularly in the neighbourhood of the cradles. Any corrosion is best dealt with by chipping down to the bare metal, and applying one or two coats of red oxide. If the tank or tanks are arranged so that air circulates well around them, sweating will be reduced and access for repair and painting will be easy.

The safety valve should be eased off its seat, say every month, to make sure that it is free. This is best done when the tank is less than half full of latex, otherwise the surge of air may deposit latex in the valve and lead to gumming.

Generally the latex in storage tanks is ammoniated. The use of ammonia precludes the use of ordinary copper and copper alloy fittings. Special copper alloys not subject to ammonia attack are available but

it is easier, and probably cheaper, to use steel instead. The arrangements for introducing ammonia into latex vary considerably. The source is invariably a cylinder of anhydrous ammonia. It is important that the connection between the gas cylinder and the ammonia pipe range is satisfactory and secure. Reliance should not be placed on connections involving the use of hose clips, as failure would allow the contents of the cylinder to discharge into the factory.

Labourers should never be permitted to enter latex storage tanks for cleaning until all practicable steps have been taken to ensure that the tank is free from gas. If a tank is left overnight with all manhole covers removed the gas will usually have dispersed by morning. It should be noted, however, that ammonia is heavier than air, and if a bottom manhole is not provided the drain valve or cock, has to be removed.

When there is the slightest doubt concerning the condition of the air in the empty tank, the labourers entering the tank should be provided with respirators suitable for use in a concentration of ammonia vapour, and some person should be stationed near the tank opening to render assistance if required.

A. NEILSON

Multiplication and Testing of New Clones

AN UP TO DATE APPRAISAL of the RRIM '600' series clones appears on page 41. Our advice to all estates receiving these and other promising clones is to establish them in small plots of at least 100 trees per plot, at a stand of not less than 150 trees per acre. Until we have the results of the statistically designed trials already established in Malaya, we are unable to recommend any of these clones for planting on more than an experimental scale of up to 12 acres.

Merely to multiply budwood after purchase is not to make the best use of it. Budwood of promising new clones may remain in nurseries which require expensive upkeep and attention for perhaps two or three years before it is used for planting out. Moreover, some of the clones may never be required for large scale planting. But the immediate establishment of such planting material in plots or trials, as suggested above, has three main advantages:

1 permanent establishment minimises the mistakes which experience has shown can occur in nurseries;

2 firsthand information on the growth and vegetative characters of the clones can be obtained early, and small scale yield recording can commence within six or seven years after the purchase of the original nucleus supply of budwood;

3 a multiplication nursery can be started just as soon as we are able to make firmer recommendations regarding particular clones. For this purpose branch budwood can be cut from the established stand, for budgrafting in a seedling stock nursery, preferably kept available near the site of the permanent tree plots.

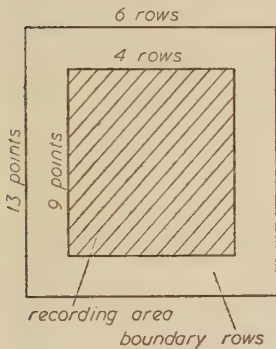
Multiplication and Testing of New Clones

TRIALS

We recommend planters who wish to record the yields of new clones accurately to follow the method which we have found to be most practical for the evaluation of new clones in our statistically designed trials. As our recommendations on RRIM clones are based on these trials, some account of their layout may also be of value.

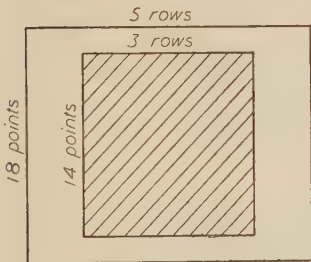
Size of Plot—We consider that the minimum number of trees recorded in each plot should be twentyfour at full maturity after all thinning has been done, and that these should not be adjacent to trees of another clone. This entails leaving guard rows round a central recording area, which should be a miniature of the plot itself. Clearly the size of the plot will increase as its shape departs from the square, as the two examples at different planting densities show. In our trials the plots are normally just under half an acre. The establishment plots which we have recommended above are larger than this, but the following method of recording is quite suitable for them too.

EXAMPLES OF PLOT DESIGNS FOR R.R.I. TRIALS



Stand per acre	Plot	Recording area
At planting: 180	Points: 78 (6 rows of 13)	Points: 36 (4 rows of 9)
At opening: 140	Area: 0.434 acre	After thinning to 120/acre: 24
Later: 120		

PLANTING DISTANCES 22 FT × 11 FT



At planting: 207	Points: 90 (5 rows of 18)	Points: 42 (3 rows of 14)
At opening: 140	Area: 0.435 acre	After thinning to 120/acre: 24
Later: 120		

PLANTING DISTANCES 30 FT × 7 FT

Tree Marking—Each tree to be recorded has a number and a band painted at sixty inches from the union. This is above the usual height for opening so that tapping is unlikely to destroy the paint band at which girths are recorded. Numbering permits individual tree histories to be recorded; throughout the duration of the trial, girth and bark measurements, brown bast incidence, storm damage, and disease, are recorded for each marked tree.

Multiplication and Testing of New Clones

Plot Recording—The yield of each marked tree is recorded after cup coagulation. In clone trials where the differences between varieties are not large and where plots are adequately replicated, cup coagulation on one normal tapping day a month is sufficient (twelve recordings per year). On this day a few drops of five per cent formic acid are placed in the cup of each marked tree. The following day the cup lumps from each plot are strung on a clearly labelled wire of standard weight. When a large trial cannot be tapped all on one day, then the recording should be on consecutive days. The procedure is then either A to dry the coagula, still on their labelled wire, in a smoke house for ten days, after which the number of lumps on each wire is counted and the bulk of coagula from each plot is weighed separately and entered on the record sheet, or, B to count the cup lumps from each plot, put them through a crepeing mill and, after returning the crepe to its correct wire, to air dry it for three to five days before weighing it.

In method A the coagula remain on the wire until they have been weighed, and since the wires are of standard weight a correction can be made. Method B is quicker but requires more careful supervision.

Both methods leave some residual moisture in the dried cup lumps, so that a correction factor is needed to calculate dry rubber. This should be determined at least once, by continuing the drying after the routine yield recording, and weighing at intervals until a constant weight is obtained. The correction factor is the ratio of this final weight to that recorded previously on the routine basis.

Should any tree be out of tapping for some reason which can be regarded as a clonal characteristic—such as brown bast, pink disease, susceptibility to wind damage, inadequate girth—then no other tree may be recorded in its place. Thus fewer cup lumps will be collected from the sample group of trees in a plot with any of these defects. Unless this principle is strictly followed, errors will arise in the estimates of yield per acre, which is the most valuable figure in comparing yields. If, on the other hand, a recording tree is destroyed by root disease, lightning damage, or termites, another tree may then be substituted.

Bulk Recording—The other record kept is the bulk yield of the entire trial. Tapping tasks may be arranged in any convenient manner, ignoring plot or block boundaries, but the tasks should cover the trial area exactly. The tappers should be changed from task to task occasionally to avoid bias due to differences in individual skill. The bulk of the latex and its dry rubber content are recorded for every task. Scrap is collected and its weight recorded.

The weights of the dried cup lumps enable the mean yield per tree per tapping to be determined for each plot, and thus for each clone. The yield per acre per annum can be estimated by multiplying the yield per tree per tapping by the stand per acre and by the estimated number of tappings per annum, but a more realistic figure can be derived from the formula:

$$\frac{\text{total weight of coagula from plot}}{\text{total weight of coagula from whole trial}} \times \frac{\text{total crop}}{\text{area of plot}}$$

The accuracy of this calculation depends largely on the accuracy with which the dry rubber content of the bulk yield is measured in the field.

Multiplication and Testing of New Clones

For a number of plots of equal size, the weights of the coagula for each plot are multiplied by a factor:

$$\frac{\text{total crop}}{\text{total coagula} \times \text{plot size}}$$

Statistical analysis of yield data may be done either on yield per tree per tapping or on the estimated yield per acre. The latter is the more realistic as it takes into account any losses in yield which have occurred through clonal susceptibility to brown bast, wind damage and other factors.

R. R. I. News

The rubber research and advisory unit, formerly working at the laboratories of the Imperial Institute under the London Advisory Committee for Rubber Research (Ceylon and Malaya), and directed by Mr George Martin as Superintendent of Rubber Investigations, has been finally amalgamated with the British Rubber Producers' Research Association.

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The manufacture of cyclised rubber masterbatch 50/50, using latex concentrate for the cyclised portion and skim latex for the other, is outlined in a pamphlet by Rubber Technical Developments, Ltd, obtainable from The Natural Rubber Development Board, Kuala Lumpur.

Natural Rubber Grades

The Rubber Manufacturers Association of New York published in February a new booklet 'Type Descriptions and Packing Specifications for Natural Rubber Grades Used in International Trade'. This publication describes for the first time the 36

types and grades of natural rubber which account for practically all international trade in the dry product. It supersedes the green book 'Type Descriptions and Packing Specifications for Natural Rubber', and the blue book 'Singapore Type Descriptions'. In the past we have provided our readers with copies of the green book on request, and we have sent out amendments from time to time. We are discontinuing this practice, because the new booklet can be obtained from several organisations in Malaya. For example, stocks are held by the Federation of Rubber Trade Associations of the Federation of Malaya, Penang, and from the Singapore Chamber of Commerce Rubber Association, Singapore.

Twentyfour of the grades are described as International grades, six additional grades continue to be described as RMA grades and six more corresponding grades continue to be described as Singapore grades. This adoption of internationally agreed standards for natural rubber was unanimously recommended by the Second International Rubber Quality and Packing Conference which was held in New York in May 1955.

The organisations concerned have agreed that no further

grades of the types described will be considered for subsequent inclusion. This does not preclude future grades covering types not yet described.

R. R. I. Patents

We seek patent protection in respect of many of our inventions with a view to securing for the whole of the planting industry free and unrestricted application of our work.

In order to keep a check of commercial applications, and to ensure that the quality of any products conforms to that required by the patent, we require that producers wishing to make use of any of our patented processes should apply to our Board for a permit to operate.

Permits are granted without charge to approved Malayan producers, but two conditions are usually imposed:

1 That we are regularly advised of the extent to which the process is being operated. Thus for field work, the area treated, and for factory work, the amount produced, are required.

2 Samples representative of the whole production are required to permit quality control. The producer will be informed of test results, should he require them.

Boric acid as preservative

British Patent Application No 32612/55 by J.E. Morris and K.C. Sekar, of our Chemical Division, describes the use of boric acid as a preservative for latex concentrate.

We have made extensive laboratory trials of this preservative system and found it satisfactory. Our experience is freely

available to Malayan producers who may wish to carry out their own tests before embarking upon bulk production.

Any company wishing to produce a quantity greater than 500 gallons of latex preserved with boric acid should apply to the Board of the Rubber Research Institute for a permit to use the process.

Pink Disease

A countrywide survey by post of pink disease incidence in relation to soil type has been completed. Assessment was based on the incidence on trees of clone RRIM 501, which has been planted throughout the country and is known to be susceptible. Enquiries were addressed to all estates to which RRIM 501 budwood had been supplied in the past, and for which records of pink disease incidence were not already available. Of 300 cards sent out, 251 were returned; 88 of these reported no RRIM 501 planting of susceptible age. The remaining replies were distributed as follows:

Disease	Soil type	
	Inland	Coastal
Negligible	22	51
Light	21	7
Medium	24	3
Heavy	35	—

This result clearly confirms what had been indicated by advisory correspondence — that pink is essentially a disease of trees growing on inland soils. The exceptions to this general rule are of great interest and will be investigated further.

The success of this survey has been due to the ready cooperation of estates to whom cards were sent.

Planters' Bulletin by Airmail

Although every effort is made to see that oversea subscribers receive their *Planters' Bulletin* on the first of the month, or as soon as possible afterwards, the present transit time of well over six weeks involves a delay which some of our subscribers in Europe and the Americas find inconvenient.

We have therefore introduced an airmail delivery of *Planters' Bulletin* for the benefit of those who are prepared to accept the extra cost on their deposit accounts. *Planters' Bulletin* will be posted by airmail from Kuala Lumpur about four days before the publication date. We do not recommend airmail delivery to subscribers within the limits of, say, Ceylon, Australia, and the Philippines. *Planters' Bulletin* comes off the press in good time for us to send it by surface mail to these and nearer countries.

We cannot give precise airmail rates, since postal rates may change, and the size of *Planters' Bulletin* varies. It is more convenient to debit subscribers' deposit accounts. At present the airmail postage to the United Kingdom or the United States of America, is \$1 (Malayan) or more on each copy.

Courses for Senior Estate Conductors

Applications will now be accepted from the managers of estates for a limited number of vacancies in refresher courses for senior estate conductors this year, at the R.R.I. Experiment Station during the weeks commencing 3 June and 24 June. Ten conductors can be taken on each course; they must be senior experienced men who are actually in employment. The programme will be mainly field work.

Please apply early, to the Director. The vacancy list will doubtless be filled quickly.

THE COVER SHOWS LATEX RECEPTION
TANKS INSIDE THE R.R.I. EXPERIMENT
STATION FACTORY AT SUNGEI BULOH.

